

SHORT REPORT

Time of day variation in rates of obstetric intervention to assist in vaginal delivery

D A Webb, J Culhane

J Epidemiol Community Health 2002;**56**:577–578

The frequency of use of commonly performed obstetric procedures to assist in vaginal delivery has been shown to vary according to characteristics of both the patient and provider, independently of clinical indications for intervention.^{1–5} This variation in procedure use according to “non-medical” factors is worthy of attention, as it raises the spectre of unnecessary intervention that increases the cost of maternity care, and possibly the risks of adverse maternal or neonatal outcomes as well. Mounting evidence of the additional maternal and neonatal morbidity associated with frequent episiotomy use⁶ and operative vaginal delivery,^{7,8} in particular, underscores the need to examine the extent, causes and consequences of the unnecessary use of these and other obstetrical interventions to assist in vaginal delivery.

Obstetrical procedures may be overused or misused, at least in part, for the purposes of convenience—that is, as a way for doctors and hospitals to control patient flow or manage time more efficiently.^{1–9,13} While there is some empirical evidence for this “convenience” hypothesis with regard to caesarean section practices,^{11,13} there is little such evidence where obstetric procedures to assist in vaginal delivery are concerned. We explored the extent to which “convenience” factors may be influencing the use of obstetric procedures other than caesarean section, for a geographically defined study population of women at relatively low risk for obstetric intervention. Specifically, the objective of the study was to document any time of day variation associated with labour augmentation, episiotomy, or instrumental delivery—variation that may indicate more willingness to perform these procedures during times when providers may be under additional pressures to influence (that is, speed up) the labour and delivery process. As episiotomy and instrumental delivery have been repeatedly associated in the research literature with increased risks for severe perineal lacerations, we also assessed the relation between any temporal patterns of procedure use and incidence of 3rd or 4th degree vaginal tears.

STUDY SAMPLE

The source of data for the study was the Philadelphia Perinatal Database. As described elsewhere,¹⁴ the database consists of computer merged data elements extracted from both electronic birth and hospital discharge summary records for about 87.3% of all Philadelphia resident deliveries occurring between 1 April 1994 and 12 March 1997. This study included only singleton deliveries involving women who were admitted in active labour (that is, labour was not induced). In addition to excluding deliveries with induced labour, we also excluded from the analyses any delivery that involved infants weighing less than 2500 or more than 4000 grams, fetal distress, prolonged, obstructed, abnormal or dysfunctional labour, as indicated on the birth certificate or hospital discharge record. The resulting study sample consisted of 37 332 vaginal live birth deliveries occurring in more than 25 Philadelphia metropolitan area hospitals, representing about 60% of the 61 187 singleton, vaginal, live birth deliveries occurring to city

residents during the four year period. A total of 3770 of the 37 332 deliveries in the study sample involved the use of vacuum (n=2557) or forceps (n=1045) or both (n=168). Of the spontaneous vaginal deliveries in the study sample, 9065 (27%) involved episiotomies, and 10 411 (31%) involved augmented labour. Almost 70% of the deliveries in the study sample involved women from minority groups (black, Asian, or Hispanic); more than 40% of the women were publicly as compared with privately insured; and more than 20% were teenagers (≤ 19 years) at the time of delivery.

RESULTS

Standardised (Z score) values pertaining to the rates of the obstetric procedures and 3rd/4th degree tears, by time of day, are presented graphically in figure 1; unstandardised rates appear in tabular form below the graph. Figure 1 shows a consistent temporal patterning of variation in vacuum/forceps use, episiotomy use, and labour augmentation, with generally higher frequencies of use during “regular” daytime/early evening hours and lower use during “off” or late evening/early morning hours. The most dramatic example is perhaps vacuum/forceps use, which varies from a low of 7.1% for deliveries during the two hour period beginning at 2 am, to a high of 12.6% for deliveries during the two hour period beginning at 12 noon. The incidence of severe perineal trauma, as measured by the number of 3rd or 4th degree perineal lacerations per 1000 deliveries, also differs considerably by time of delivery, with a pattern of variation mapping closely to that for labour augmentation, episiotomy use, and vacuum/forceps delivery. Thus, there is a positive association between swings in procedure use and maternal morbidity, at least as measured here by the incidence of severe perineal tears.

Results of logistic regression analysis of the data confirmed the findings presented in figure 1, and suggest that the observed temporal variations cannot be explained based on any differences in sociodemographic composition of mothers giving birth, insurance status, parity, infant birth weight, or estimated length of labour (data not shown). For all measures, the adjusted odds ratios were significantly higher for the 10 am to 10 pm as compared with the 2 am to 8 am period (data not shown). More specifically, patients confronted odds of undergoing an instrumental delivery, of having an episiotomy, of labour augmentation, and of incurring a 3rd or 4th degree tear that were 43%, 10%, 86%, and 30% higher, respectively, for the daytime/early evening as compared with night-time/early morning hours.

COMMENTS

The most significant limitation of the study was the inability to account for all of the factors that could both influence procedure rates and vary according to the time of day of delivery. We could not, for example, examine the affects of epidural analgesia; use of the procedure was not routinely documented on the birth or hospital discharge summary records, which were the only two sources of data for the study. Epidural analgesia has been shown to prolong labour, increase oxytocin use

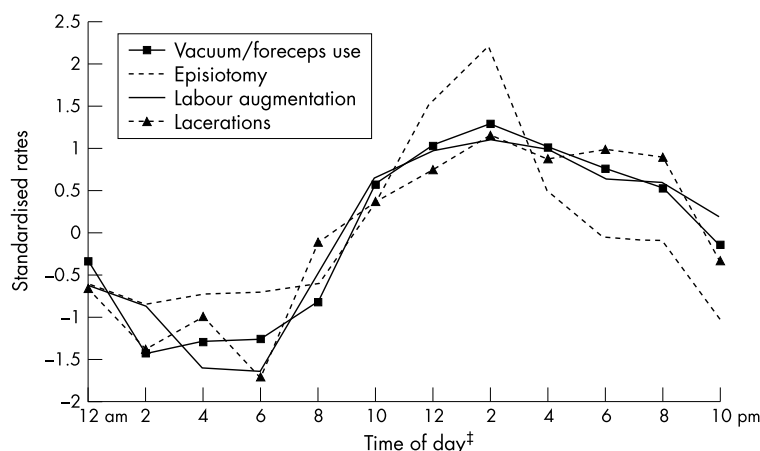


Figure 1 Rates of vacuum/forceps use, episiotomy use, labour augmentation, and severe lacerations by time of delivery. * Labour augmentation and episiotomy rates pertain only to spontaneous vaginal deliveries. †Refers to the occurrence of 3rd and 4th degree tears per 1000 deliveries. ‡Values on x axis refer to the two hour time period beginning with hour shown.

% Vacuum forceps –	9.3	7.1	7.4	7.5	8.4	11.1	12.1	12.6	12.0	11.5	11.1	9.7
% Episiotomy*–	24.7	24.3	24.5	24.5	24.7	26.3	28.3	29.4	26.5	25.6	25.6	24.0
% Augmented*–	25.7	24.4	21.0	20.8	26.3	34.4	37.7	39.3	37.9	34.3	34.0	30.7
Lacerations†–	43.7	37.3	40.8	34.4	48.9	53.3	56.7	60.3	57.8	58.8	57.9	46.8
(per 1000 births)												

to augment labour, and increase the likelihood of instrumented vaginal delivery^{15–17}; and it is conceivable that, because of understaffing, availability could vary according to time of day. However, an analysis of the data for a subgroup of deliveries occurring in the eight largest hospitals in the city—known to maintain 24 hour in house obstetrical and anaesthesia teams—showed the same pattern of results as the analysis for the entire study sample, indicating that time of day variation in epidural use is unlikely to account for the findings reported here.

Limitations notwithstanding, the results would seem to be difficult to explain, without reference to the influence of “time” itself—that is, to the increased pressures on doctors and hospital staff to “clear” patients at times when they have other patients to see and/or when the hospital census is high. Busy doctors in busy hospitals may simply have less tolerance for the otherwise time consuming natural progression of labour and delivery during “high demand” hours, and thus are more willing during these times to perform procedures that hasten the labour and delivery process. The fact that incidences of 3rd or 4th degree lacerations are high at roughly the same times that procedure use is high is consistent with what is known about the risks associated with episiotomy and vacuum/forceps use, and suggests that efforts to influence the timing of births through more liberal use of obstetric interventions may increase the morbidity associated with vaginal delivery.

Additional studies are warranted to confirm the generalisability of these findings to other populations, either within or outside of the United States. To the extent they are generalisable, the findings highlight the need for hospitals (1) to examine their own data regarding non-medically indicated variations in obstetric procedure use, including that related to time of birth; (2) to identify internal staffing and other practices that may be contributing to any avoidable, excess use of obstetric procedures; and (3) to document and take measures to prevent any unnecessary maternal or infant morbidity that may be resulting from such use.

Authors' affiliations

D A Webb, Philadelphia Department of Public Health, USA
J Culhane, Thomas Jefferson University, Department of Obstetrics and Gynecology, USA

Correspondence to: Dr D A Webb, Philadelphia Department of Public Health, 500 S Broad Street Philadelphia, PA 19146, USA; David.Webb@Phila.Gov

Accepted for publication 11 February 2002

REFERENCES

- 1 Roberts CL, Tracy S, Peat B. Rates for obstetric intervention among private and public patients in Australia: population based descriptive study. *BMJ* 2000;**15**:137–41.
- 2 Rosenblatt RA, Dobie SA, Hart LG, et al. Interspecialty differences in the obstetric care of low-risk women. *Am J Public Health* 1997;**87**:344–51.
- 3 Robinson JN, Norwitz ER, Cohen AP, et al. Predictors of episiotomy use at first spontaneous vaginal delivery. *Obstet Gynecol* 2000;**96**:214–18.
- 4 Hueston WJ. Factors associated with the use of episiotomy during vaginal delivery. *Obstet Gynecol* 1996;**87**:1001–5.
- 5 Reid AJ, Carroll JC, Ruderman J, et al. Differences in intrapartum obstetric care provided to women at low risk by family physicians and obstetricians. *Can Med Assoc J* 1989;**140**:625–33.
- 6 Carroli G, Belizan J. Episiotomy for vaginal birth. *Cochrane Database Syst Rev* 2000;**2**:CD000081.
- 7 Brown S, Lumley J. Maternal health after childbirth: results of an Australian population based survey. *Br J Obstet Gynaecol* 1998;**105**:156–61.
- 8 Sultan AH, Kamm MA, Hudson CN, et al. Anal-sphincter disruption during vaginal delivery. *N Engl J Med* 1993;**329**:1905–11.
- 9 Yeomans ER, Hankins GD. Operative vaginal delivery in the 1990's. *Clin Obstet Gynecol* 1992;**35**:487–93.
- 10 Ryden G. Vacuum extraction or forceps? *BMJ* 1986;**292**:343–4.
- 11 Burns LR, Geller SE, Wholey DR. The effect of physician factors on the cesarean section decision. *Med Care* 1995;**33**:365–82.
- 12 Fraser W, Usher RH, McLean FH, et al. Temporal variation in rates of cesarean section for dystocia: does “convenience” play a role? *Am J Obstet Gynecol* 1987;**156**:300–4.
- 13 Evans MI, Richardson DA, Sholl JS. Cesarean section. Assessment of the convenience factor. *J Reprod Med* 1984;**29**:670–83.
- 14 Webb D, Culhane JF, Snyder S, et al. Pennsylvania's early discharge legislation: effect on maternity and infant lengths of stay and hospital charges in Philadelphia. *Health Serv Res* 2001;**35**:1073–83.
- 15 Howell CJ. Epidural versus non-epidural analgesia for pain relief in labour. *Cochrane Database Syst Rev* 2000;**2**:CD000331.
- 16 Zhang J, Klebanoff MA, DerSimonian R. Epidural analgesia in association with duration of labor and mode of delivery: a quantitative review. *Am J Obstet Gynecol* 1999;**180**:970–7.
- 17 Halpern SH, Leighton BL, Ohlsson A, et al. Effect of epidural vs parenteral opioid analgesia on the progress of labor: a meta-analysis. *JAMA* 1998;**280**:2105–10.